Lawrence Berkeley National Laboratory

Recent Work

Title

CURRENT REGULATOR FOR ""FLOATING"" WIRE USED IN MAGNET CALIBRATION

Permalink

<https://escholarship.org/uc/item/82v7m374>

Authors

Lutz, Ivan C.
Pike, Chester P.

Publication Date

1959-03-01

UNIVERSITY OF
CALIFORNIA

*Radiation
Laboratory*

TWO-WEEK LOAN COPY

*This is a Library Circulating Copy
which may be borrowed for two weeks.
For a personal retention copy, call
Tech. Info. Division, Ext. 5545*

BERKELEY, CALIFORNIA

UCRL 86939
cy 2

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

UNIVERSITY OF CALIFORNIA

**Lawrence Radiation Laboratory
Berkeley, California**

Contract No. W-7405-eng-48

**CURRENT REGULATOR FOR "FLOATING" WIRE
USED IN MAGNET CALIBRATION**

Ivan Lutz and Chester Pike

March 1959

CURRENT REGULATOR FOR "FLOATING" WIRE USED IN MAGNET CALIBRATION*

Ivan Lutz and Chester Pike

Lawrence Radiation Laboratory
University of California
Berkeley, California

March 1959

A useful and well-known method for calibrating a beam-analyzing magnet is to "float" a current-carrying fine wire in its field. In a given field, the wire assumes the path taken by a particle of charge e traveling with momentum mv , for

$$T/i = mv/e,$$

where T = the tension and i = the current in the wire.[†] The calibration procedure involves keeping the tension and current constant in the floating wire, while adjusting the magnetic field to bring the wire into the desired trajectory.

In the momentum range of several hundred to several thousand Mev/c, we have been most successful using a tension of 200 to 500 g with a corresponding current. We typically use a 14-strand no. -44 insulated wire, the insulation taking most of the tension.

Under these conditions, the general requirements for a power supply for the floating wire are that the current be regulated to at least 0.5% (at 1 amp) against the following:

- a. fast changes of 2% in input voltage occurring in two cycles out of 60 cps;

*

Work done under auspices of U. S. Atomic Energy Commission.

†

Lawrence Cranberg, Magnet Calibration by the Floating-Wire Method, AECU-1670, Nov. 23, 1951; Glen R. Lambertson, Use of the Wire Loop in Locating the Orbital Surface of a Cyclotron Field, UCRL-3366, Mar. 21, 1956.

- b. slow changes of 2% in input voltage occurring in $\sim 1/2$ sec;
- c. load changes of 10% in ~ 5 sec (due to thermal effects in the floating wire).

In addition, provision must be made for continuous current adjustment and for reversing the polarity of the load voltage. A useful range is 0.25 to 4 amp and 0 to 100v, since the load is typically between 20 and 100 ohms. Ripple should not exceed 1% peak-to-peak over the range from 1 amp to 4 amp.

Because commercial current regulators are unavailable in this range, the transistorized regulator shown schematically in Fig. 1 was developed. The amplifier in the negative feedback loop and its individual regulated power supply are built on plug-in boards, to facilitate maintenance and give greater compactness. The current regulator, together with its 140-v power supply (not shown in Fig. 1), takes up only 17 in. of vertical space in an electronic rack. A useful feature of the regulator circuit is that the transistors are self-protected against transients, which would occur if the floating wire broke or shorted out.

The 140-v dc power supply consists of a 3-phase full-wave silicon-rectifier-type supply with variac control from 0 to 140 v output. Input is 230v 3-phase. The power supply for the regulator amplifier requires 120 v single phase, which is obtained from a step-down transformer from the ²³⁰20-v line.

LEGEND

Fig. 1. Circuit schematic of current regulator. Those resistor values > 10 are in ohms, and those < 10 in kilohms, except as noted. All capacitor values are in μf .